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## (54) Liquid crystal cell arrangement for antiglare glasses

(57) An arrangement for driving liquid  
crystal cells in antiglare glasses, in  
which an adjustment to the varying  
light conditions is achieved on the basis  
of a self-acting transparency control.

A plurality of first liquid crystal cells  
(7.1, 7.2, 7.3), form an eye shield and are  
electrically connected to light sensors  
(4.1, 4.2, 4.3) via driving units (5.1, 5.2,  
5.3). A further liquid crystal cell (3) is  
disposed in front of the light sensors  
(4.1, 4.2, 4.3) and is arranged to act as a  
variable light filter. The cell (3) is  
connected via a driving unit (2) to an  
additional light sensor (1) which is  
arranged to control the cell (3) in  
response to the ambient luminance.

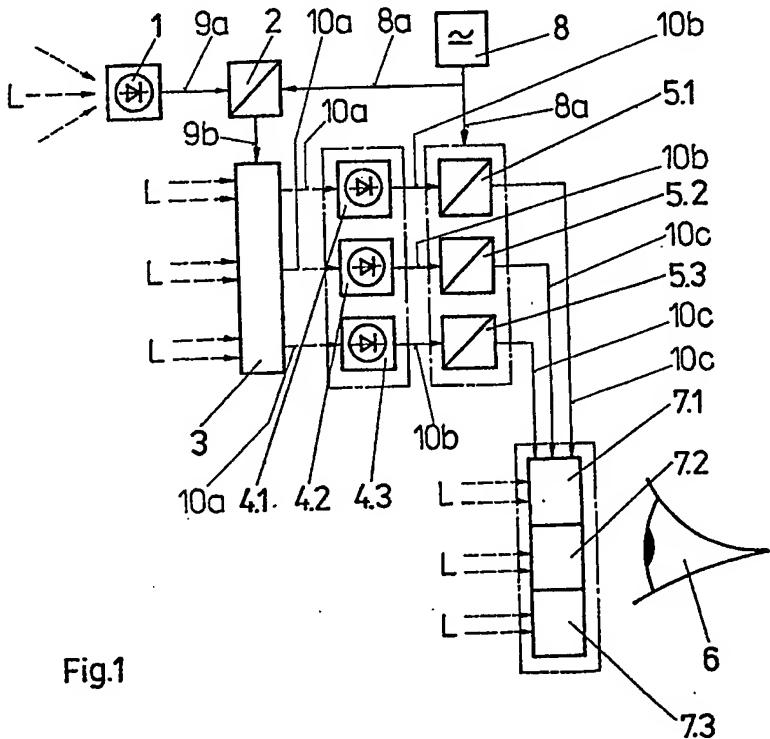


Fig.1

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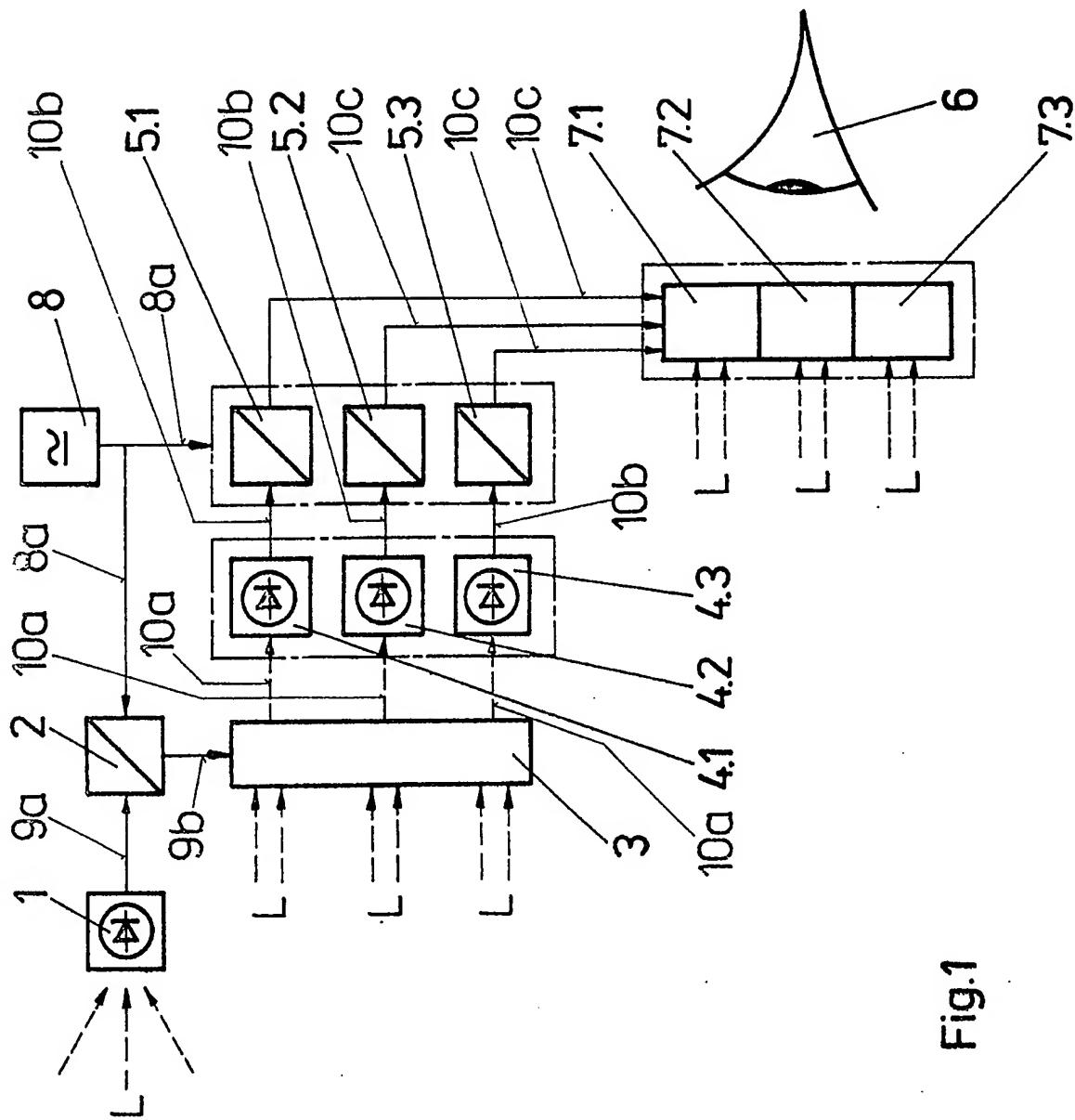


Fig.1

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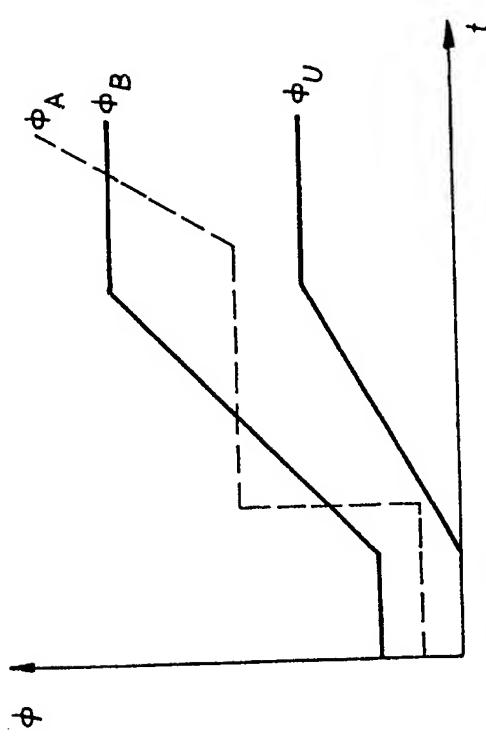


Fig.3

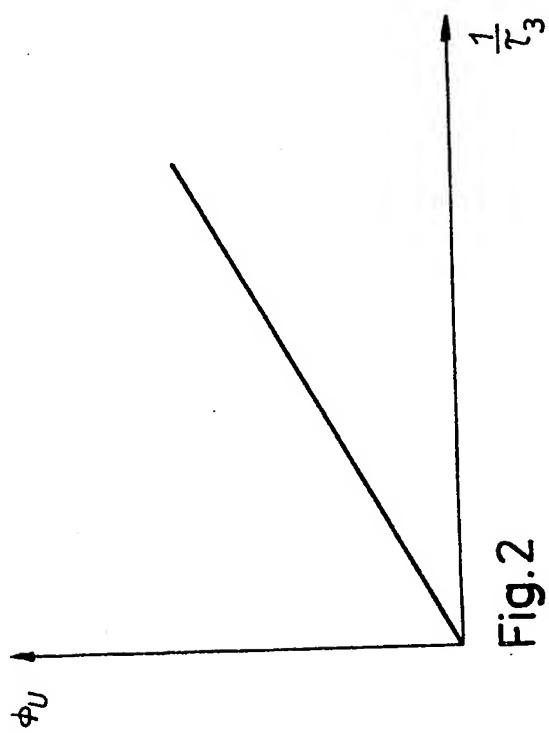


Fig.2

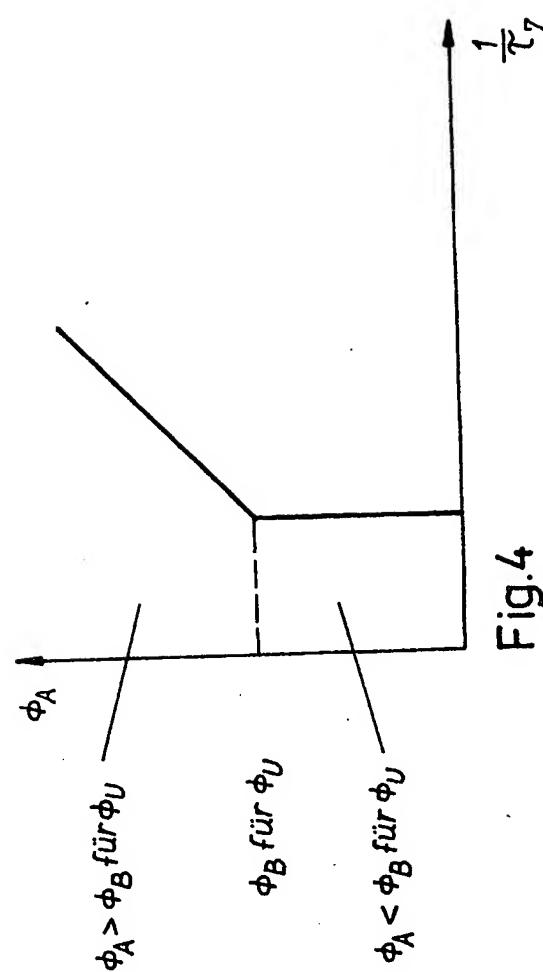


Fig.4

## SPECIFICATION

**Liquid crystal cell arrangement for antiglare glasses**

5 The invention relates to a liquid crystal cell arrangement for antiglare glasses.

It is known in the art to achieve a transparency control of a plurality of liquid crystal cells dependant on the ambient light conditions using a reference signal detected by means of a light sensor. This reference signal represents a measure for the transparency control or, in fact, the controlling quantity for the latter. Consequently, this would mean that, for example in accordance with G.D.R. Patent application No. A 61F 243 77 1/1, for the embodiment of a transparency control for separately drivable liquid crystal cells being treated as a whole functional unit, it is essential to compare the value of the incident luminous intensity to a predetermined value of the 15 luminous intensity considered to be the glaring value, for every liquid crystal cell or each group of such cells being compared with the light sensor. This comparison results in a signal representing the difference between the value of the incident intensity 20 and the glaring value. Because this signal is not in itself sufficient for driving the liquid crystal cells it must be amplified afterwards. Furthermore, it is known that the level of luminous intensity causing glare depends on the ambient light conditions. For 25 example, a light source can be perceived as a glare during night-time, when the human eye can only cope with small brightness differences, whereas the same light source does not appear as a glare in the day-time when the human eye can cope with larger 30 brightness differences. The glaring value is, hence, not a constant but a variable quantity, which is dependant on the ambient brightness conditions.

It is an object of the invention to provide an 40 arrangement for driving liquid crystal cells in antiglare glasses, wherein the transparency control of the liquid crystal cells adjusts to the varying ambient light conditions automatically.

It is a further object of the invention to provide an 45 arrangement for driving liquid crystal cells in antiglare glasses, which relates the luminances possibly causing a glare, automatically to the ambient light conditions.

According to the present invention, there is provided a liquid crystal arrangement for antiglare 50 glasses, comprising a plurality of first liquid crystal cells, which form an eye shield and which are electrically connected to first light sensors via first driving units, and an additional liquid crystal cell which is disposed in front of said first light sensor 55 and which is arranged to act as a variable filter, said additional liquid crystal cell being connected, via a second driving unit, to an additional light sensor which is adapted to respond to the ambient luminance. Advantageously, each driving unit includes a 60 control member for setting the response threshold of the arrangement and for aligning the transmission coefficient of the driving units.

Advantageously, the sensitivities of the first and 65 additional light sensors are equal and the transmission coefficients of the first and second driving units

are equal, and the material of the liquid crystal cells forming the eye shield has a flatter electro-optical characteristic than that of the material of the liquid crystal cell acting as a variable filter.

70 Preferably, the sensitivities of the first light sensors which are electrically connected to the liquid crystal cells forming the eye shield are lower than that of the said additional light sensor for measuring the ambient luminance, the electro-optical characteristics of the liquid crystal cells being congruent and the transmission coefficients of the driving units being equal.

Advantageously, if the electro-optical characteristics of the liquid cells are congruent and the 75 sensitivities of the light sensors are equal, the transmission coefficients of the driving units electrically connected to the liquid crystal cells forming the eye shield, are lower than the transmission coefficient of that driving unit, which is electrically connected to the liquid crystal cell acting as a variable filter.

To relate a luminance which might cause a glare to the ambient average luminance, it is necessary for the transmittance of the liquid crystal cell which is 80 disposed in front of the light sensors to vary as a function of the ambient brightness in the same mode as the luminance, which might cause a glare, varies as a function of the ambient luminance. Hence, it is an advantage to set a response threshold for the 85 liquid crystal cells of the eye shield, with the exceeding of the threshold being equivalent to a glare effect and causing the liquid crystal cells to be obscured in dependence on the luminance.

It can occur that one and the same signal value, 90 which causes the liquid crystal cells of the eye shield to be obscured, corresponds to different luminances, each causing a glare, in dependence on the ambient luminance.

Advantageously, the entire driving process is 95 reduced to a comparison to a fixed value, which is the response threshold.

It is an advantage of the present arrangement that it can be achieved using simple electronics. There is no comparing of the measured parameters to state 100 differences between them and, hence, no differential amplifier is necessary. These features permit, advantageously, the use of the portable arrangement under constantly varying light conditions. Adaption to the relevant light conditions is carried out automatically. Additionally, it is an advantage of the present 110 arrangement that it permits the embodiments wherein the compensation of manufacturing tolerances can be achieved by the use of control members provided in the driving units.

120 Furthermore, the arrangement is particularly appropriate for both day and night usage of the antiglare glasses since the varying ambient light conditions are automatically taken into account.

The present invention will now be described 125 further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 shows an arrangement in accordance with the present invention for driving a plurality of liquid crystal cells in antiglare glasses;

130 Figure 2 shows a diagrammatic representation of

the transmittance  $\tau_3$  as a function of the ambient luminance  $\Phi_u$ .

Figure 3 shows the relation between the ambient luminance  $\Phi_u$  and the luminance  $\Phi_B$  being perceived 5 as a glare dependant on the time  $t$ ; and

Figure 4 shows the transmittance  $\tau_7$  as a function of the luminance  $\Phi_A$  in a restricted angle of vision range.

In Figure 1 the schematic representation of an 10 arrangement for driving a plurality of liquid crystal cells in antiglare glasses is shown. The antiglare glasses consist of eye shields mounted in a frame (not visible) with arms (not visible). The eye shields are formed from liquid crystal cells 7.1, 7.2, 7.3. Light 15 sensors 1, 4.1, 4.2, 4.3, oriented towards the optical viewing direction, as well as associated driving units 5.1, 5.2, 5.3, are mounted in the frame of the eye shields. A liquid crystal cell 3, acting as a variable filter, is disposed in front of the light sensors 4.1, 4.2, 20 4.3, and, as a result, the incident light  $L$  impinges as a filtered attenuated light 10a on the light sensors 4.1, 4.2, 4.3. The light sensor 1 for measuring the ambient luminance is not covered by the liquid crystal cell 3, but, via signal lines 9a (input), 9b 25 (output) and a driving unit 2, is directly electrically connected to it. The light sensors 4.1, 4.2, 4.3, in turn, are connected to the relevant sections of the liquid crystal cells 7.1, 7.2, 7.3 forming the eye shield for the human eye 6. In detail, this electrical connection 30 is embodied as follows: the light sensors 4.1, 4.2, 4.3 are connected to the driving units 5.1, 5.2, 5.3 via the respective signal lines 10b, and the driving units 5.1, 5.2, 5.3, in turn, are connected to the liquid crystal cells 7.1, 7.2, 7.3 via the signal lines 10c. A power 35 supply unit 8 is connected to the driving units 2 and 5.1, 5.2, 5.3 via signal lines 8a. The driving units 2, 5.1, 5.2, 5.3 each include a control member (not visible) for aligning the transmission coefficient of said driving units.

40 The representations in Figures 2 to 4 are used to illustrate the mode of operation of the abovedescribed arrangement.

The light sensors 4.1, 4.2, 4.3 and the appertaining driving units 5.1, 5.2, 5.3 are matched to the liquid 45 crystal cells 7.1, 7.2, 7.3 such that, when a preset threshold value of light intensity is exceeded, a signal is delivered by the relevant driving units 5.1, 5.2, 5.3, which effects a variation of the transmittance  $\tau_7$  of the affected sections of the liquid crystal 50 cells 7.1, 7.2, 7.3. Above the threshold value of light intensity, the transmittance  $\tau_7$  is varied in dependence on the luminance  $\Phi_B$  of the glaring radiation.

The filtered light impinging onto the light sensors 4.1, 4.2, 4.3 is controlled in dependence on the 55 ambient luminance  $\Phi_u$  by the light sensor 1, the driving unit 2 and the liquid crystal cell 3. Figure 2 shows a diagrammatic representation of the transmittance  $\tau_3$  as a function of the ambient luminance  $\Phi_u$ .

60 As is known, the luminance  $\Phi_B$  being perceived as a glare depends on the ambient luminance  $\Phi_u$ , as it is represented in Figure 3 in dependence on the time  $t$ . This means that in a restricted angle of vision range and at a certain value of the ambient luminance  $\Phi_u$ , the luminance  $\Phi_B$  is only then perceived

as glaring if it exceeds the value  $\Phi_B$ . In the graph of Figure 4, the luminances  $\Phi_A$  is subdivided into sections  $\Phi_A < \Phi_B$  at a certain ambient luminance  $\Phi_u$  and  $\Phi_A > \Phi_B$  at a certain ambient luminance  $\Phi_u$ , the 70 graph indicating the relation between  $\Phi_A$  and  $\tau_7$ . Since the light sensors 4.1, 4.2, 4.3, changing the transmittance  $\tau_7$  of the liquid crystal cells 7.1, 7.2, 7.3, are optically coupled with the liquid crystal cell 3 acting as a filter, and the transmittance  $\tau_3$  of the 75 liquid crystal cell 3 changes as a function of the ambient luminance  $\Phi_u$ , it is achieved that the transmittance  $\tau_7$  changes in dependence on the luminance  $\Phi_A$ , occurring in a restricted angle of vision range, and on the ambient luminance  $\Phi_u$  80 provided that  $\Phi_A > \Phi_B$  for a certain  $\Phi_u$ . Hence, the arrangement is automatically adjusted to the specific light conditions  $L$ , and, for that purpose, the required dependent between the ambient luminance  $\Phi_u$  and the luminance  $\Phi_B$  being perceived as a glare, is 85 obtained by a simple optical coupling system.

Possibilities for obtaining the required dependence between  $\Phi_A$  and  $\Phi_B$ , which are predetermined by the transmittance of liquid crystal cell 3:  $\tau_3$ , and the transmittance  $\tau_7$  of the liquid crystal cells 7.1, 7.2, 90 7.3, dependent on  $\Phi_u$  or  $\Phi_A$ , respectively, are given in the form of the sensitivities of the light sensors 1, 4.1, 4.2, 4.3, the transmission coefficients of the driving units 2, 5.1, 5.2, 5.3, and the behaviour of the electro-optical characteristic of the liquid crystal cells 95 7.1, 7.2, 7.3. The said required dependencies are obtained by adjusting the transmission coefficients. This is carried out, first of all, by means of the control members (not visible) of the driving units 2, 5.1, 5.2, 5.3. At the same time, the response threshold of the 100 liquid crystal cells 7.1, 7.2, 7.3 is set, with the exceeding of the response threshold effecting a variation of the transmittance  $\tau_7$ . The transmittance  $\tau_3$  of the liquid crystal cell 3 has no response threshold, as is indicated in Figure 2.

## 105 CLAIMS

1. A liquid crystal cell arrangement for antiglare glasses, comprising a plurality of first liquid crystal cells, which form an eye shield and which are electrically connected to first light sensors via first driving units and an additional liquid crystal cell which is disposed in front of said first light sensors and which is arranged to act as a variable filter, said 115 additional liquid crystal cell being connected, via a second driving unit, to an additional light sensor which is adapted to respond to the ambient luminance.

2. An arrangement as claimed in claim 1, where- 120 in the first and second driving units each include a control member for setting the response threshold of the arrangement and for adjusting the transmission coefficient of the driving units.

3. An arrangement as claimed in claim 1, where- 125 in the sensitivities of the first and additional light sensors are equal and the transmission coefficients of the first and second driving units are equal and the material of the liquid crystal cells forming the eye shield has a flatter electro-optical characteristic than that of the material of the liquid crystal cell acting as

a variable filter.

4. An arrangement as claimed claim 1, wherein the sensitivities of the first light sensors which are electrically connected to the liquid crystal cells forming the eye shield are lower than that of the said additional light sensor for measuring the ambient luminance, the electro-optical characteristics of the liquid crystal cells being congruent and the transmission coefficients of the driving units being equal.
- 10 5. An arrangement as claimed in claim 1, wherein the transmission coefficients of the first driving units electrically connected to the liquid crystal cells forming the eye shield are lower than the transmission coefficient of said second driving unit, which is electrically connected to the liquid crystal cell acting as a variable filter, the electro-optical characteristics of the first and additional liquid crystal cells being congruent and the sensitivities of the first and second light sensors being equal.
- 15 6. A liquid crystal cell arrangement for antiglare glasses, constructed and adapted to operate substantially as herein described with reference to and as illustrated by the accompanying drawings.

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